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THIRD EDITION

ELEMENTARY ALGEBRA WITH APPLICATIONS

Terry H. Wesner
Henry Ford Community College

Harry L. Nustad

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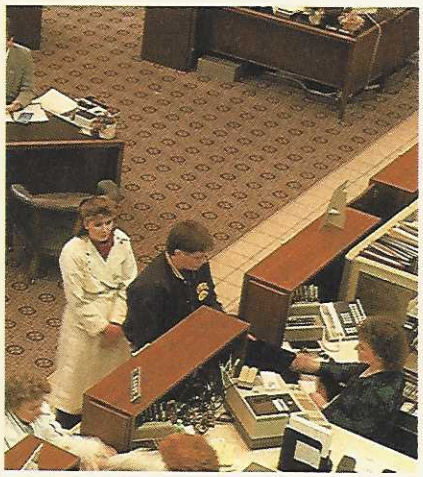
Contents

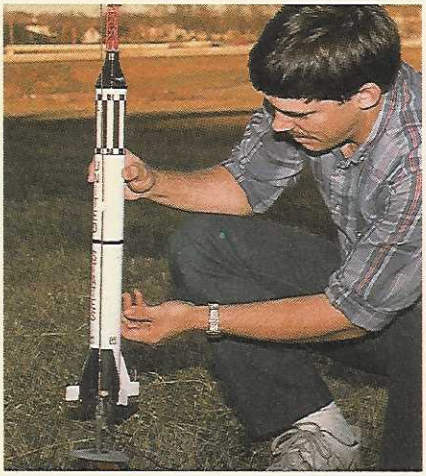
Chapter 1 ■ Operations with real numbers

Chapter 2 ■ Solving equations and inequalities



Chapter 3 ■ Polynomials and exponents

Chapter 4 ■ Factoring and solution of quadratic equations by factoring



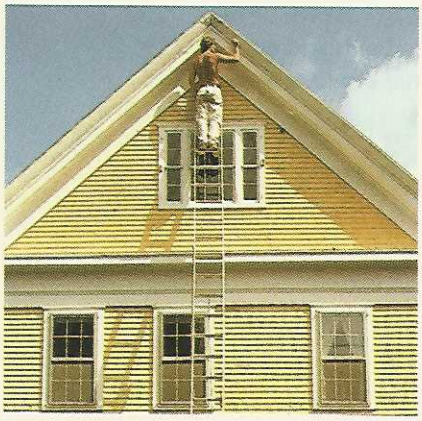
Chapter 5 ■ Rational Expressions, Ratio and Proportion

Chapter 6 ■ Operations with Rational Expressions

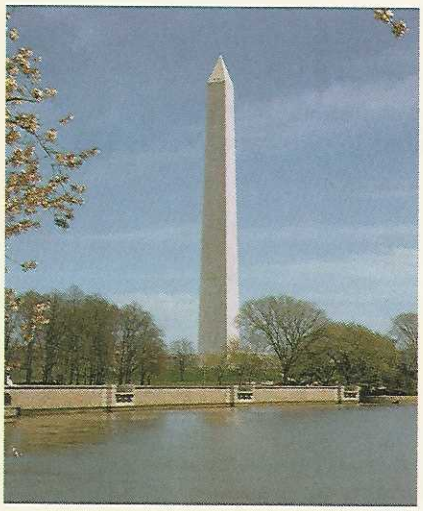
Chapter 7 ■ Linear Equations in Two Variables

Chapter 8 ■ Systems of Linear Equations

Chapter 9 ■ Roots and Radicals



Chapter 10 ■ Solutions of Quadratic Equations



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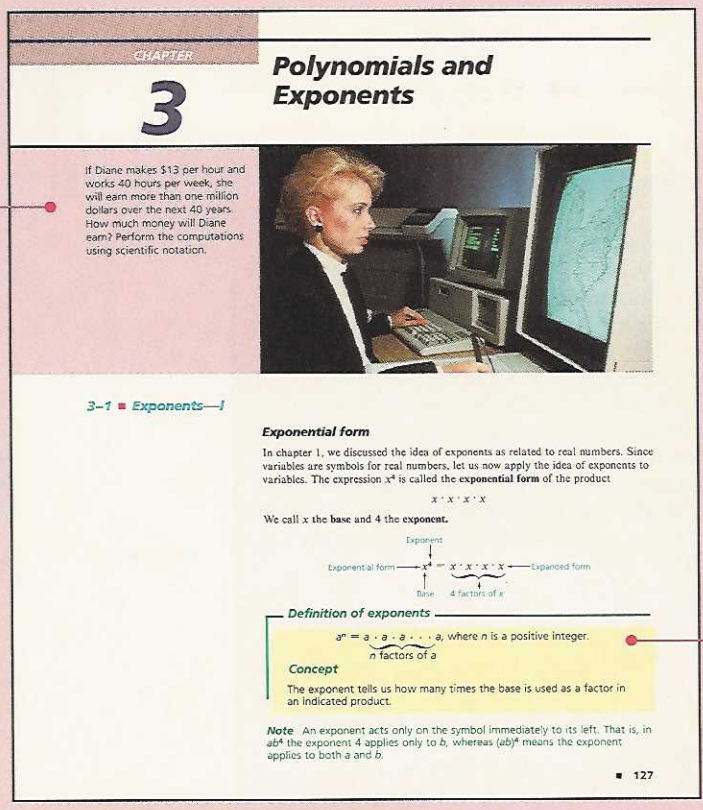
1. Chapter Lead-in Problem and Solution
2. Explanations
3. Examples
4. Quick Checks
5. Procedure Boxes
6. Definitions
7. Concepts
8. Notes
9. Problem Solving
10. Mastery Points
11. Section Exercises
12. Quick-Reference Examples
13. Trial Problems
14. Core Exercise Problems
15. Section Review Exercises
16. Chapter Summary
17. Error Analysis
18. Critical Thinking
19. Chapter Review Exercises
20. Cumulative Test



CHAPTER 3

Polynomials and Exponents

If Diane makes $13 per hour and works 40 hours per week, she will earn more than one million dollars over the next 40 years. How much money will Diane earn? Perform the computations using scientific notation.

3–1 ■ Exponents—I

Exponential form

In chapter 1, we discussed the idea of exponents as related to real numbers. Since variables are symbols for real numbers, let us now apply the idea of exponents to variables. The expression x^4 is called the **exponential form** of the product

$$x \cdot x \cdot x \cdot x$$

We call x the **base** and 4 the **exponent.**

Exponent
Exponential form → $x^4 = \underbrace{x \cdot x \cdot x \cdot x}_{4 \text{ factors of } x}$ ← Expanded form
Base

Definition of exponents

$a^n = \underbrace{a \cdot a \cdot a \cdots a}_{n \text{ factors of } a}$, where n is a positive integer.

Concept

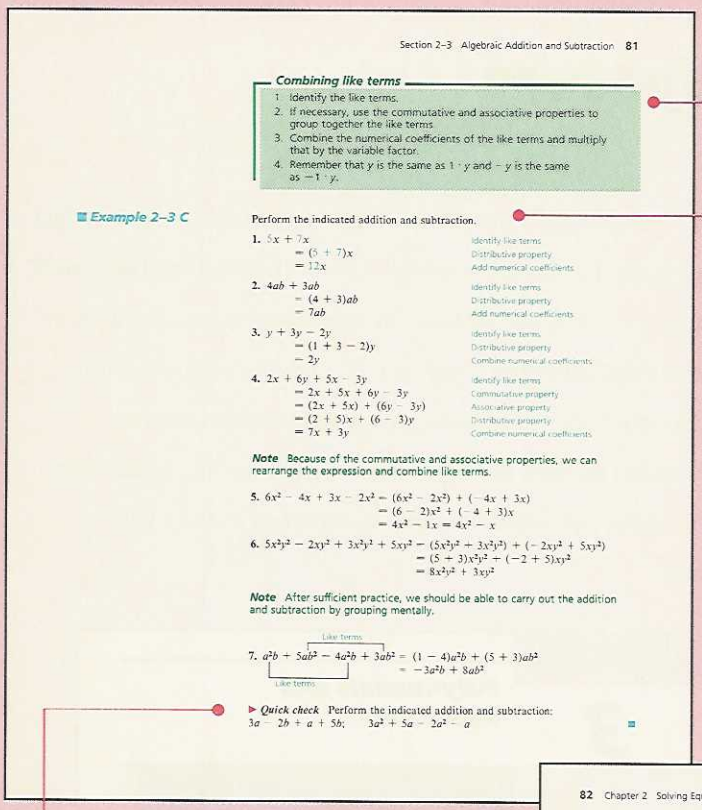
The exponent tells us how many times the base is used as a factor in an indicated product.

Note An exponent acts only on the symbol immediately to its left. That is, in ab^4 the exponent 4 applies only to b, whereas $(ab)^4$ means the exponent applies to both a and b.

■ 127

A **chapter-opening application** problem with full-color photo poses a problem that students will learn to solve as they progress through the chapter. Its step-by-step solution is shown before the chapter summary.

Definitions are stated precisely in easy-to-understand terms.



Section 2–3 Algebraic Addition and Subtraction 81

Combining like terms

1. Identify the like terms.
2. If necessary, use the commutative and associative properties to group together the like terms.
3. Combine the numerical coefficients of the like terms and multiply that by the variable factor.
4. Remember that y is the same as $1 \cdot y$ and $-y$ is the same as $-1 \cdot y$.

Example 2–3 C

Perform the indicated addition and subtraction.

1. $5x + 7x$
   $= (5 + 7)x$ — Distributive property
   $= 12x$ — Add numerical coefficients

2. $4ab + 3ab$
   $= (4 + 3)ab$ — Distributive property
   $= 7ab$ — Add numerical coefficients

3. $y + 3y - 2y$
   $= (1 + 3 - 2)y$ — Distributive property
   $= 2y$ — Combine numerical coefficients

4. $2x + 6y + 5x - 3y$
   $= 2x + 5x + 6y - 3y$ — Commutative property
   $= (2x + 5x) + (6y - 3y)$ — Associative property
   $= (2 + 5)x + (6 - 3)y$ — Distributive property
   $= 7x + 3y$ — Combine numerical coefficients

Note Because of the commutative and associative properties, we can rearrange the expression and combine like terms.

5. $6x^2 - 4x + 3x - 2x^2 = (6x^2 - 2x^2) + (-4x + 3x)$
   $= (6 - 2)x^2 + (-4 + 3)x$
   $= 4x^2 - 1x = 4x^2 - x$

6. $5x^2y^2 - 2xy^2 + 3x^2y^2 + 5xy^2 = (5x^2y^2 + 3x^2y^2) + (-2xy^2 + 5xy^2)$
   $= (5 + 3)x^2y^2 + (-2 + 5)xy^2$
   $= 8x^2y^2 + 3xy^2$

Note After sufficient practice, we should be able to carry out the addition and subtraction by grouping mentally.

7. $a^2b + 5ab^2 - 4a^2b + 3ab^2 = (1 - 4)a^2b + (5 + 3)ab^2$
   (Like terms; Like terms) $= -3a^2b + 8ab^2$

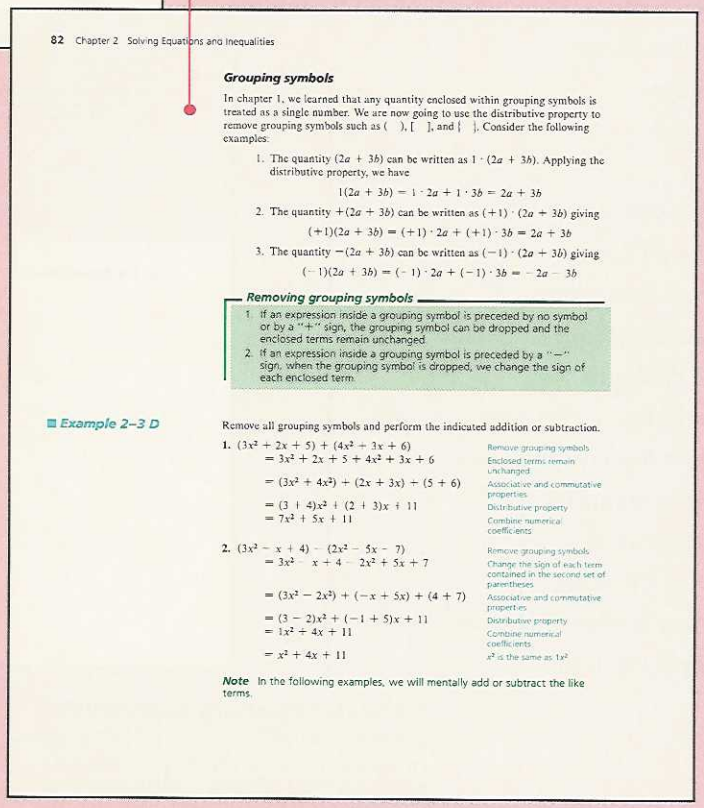
▶ **Quick check** Perform the indicated addition and subtraction:
$3a - 2b + a + 5b$; $3a^2 + 5a - 2a^2 - a$

Procedure boxes clearly state step-by-step processes for working problems.

Examples include arrows that visually guide students through steps needed to solve the problem. A detailed explanation to the right of each step ensures student understanding of the correct solution method.

Explanations are written as if the authors are talking directly to students.

Quick checks parallel the development of examples within the text and allow students to immediately test their understanding of the material being studied. The quick check problem is worked step-by-step within the exercise set. The student is able to line-by-line check his or her own solution and use this solution as a quick reference while doing the problems within the exercise set. Notice that these quick check problems become the quick-reference examples on page 84.



82 Chapter 2 Solving Equations and Inequalities

Grouping symbols

In chapter 1, we learned that any quantity enclosed within grouping symbols is treated as a single number. We are now going to use the distributive property to remove grouping symbols such as ( ), [ ], and { }. Consider the following examples:

1. The quantity $(2a + 3b)$ can be written as $1 \cdot (2a + 3b)$. Applying the distributive property, we have
   $$1(2a + 3b) = 1 \cdot 2a + 1 \cdot 3b = 2a + 3b$$
2. The quantity $+(2a + 3b)$ can be written as $(+1) \cdot (2a + 3b)$ giving
   $$(+1)(2a + 3b) = (+1) \cdot 2a + (+1) \cdot 3b = 2a + 3b$$
3. The quantity $-(2a + 3b)$ can be written as $(-1) \cdot (2a + 3b)$ giving
   $$(-1)(2a + 3b) = (-1) \cdot 2a + (-1) \cdot 3b = -2a - 3b$$

Removing grouping symbols

1. If an expression inside a grouping symbol is preceded by no symbol or by a "+" sign, the grouping symbol can be dropped and the enclosed terms remain unchanged.
2. If an expression inside a grouping symbol is preceded by a "−" sign, when the grouping symbol is dropped, we change the sign of each enclosed term.

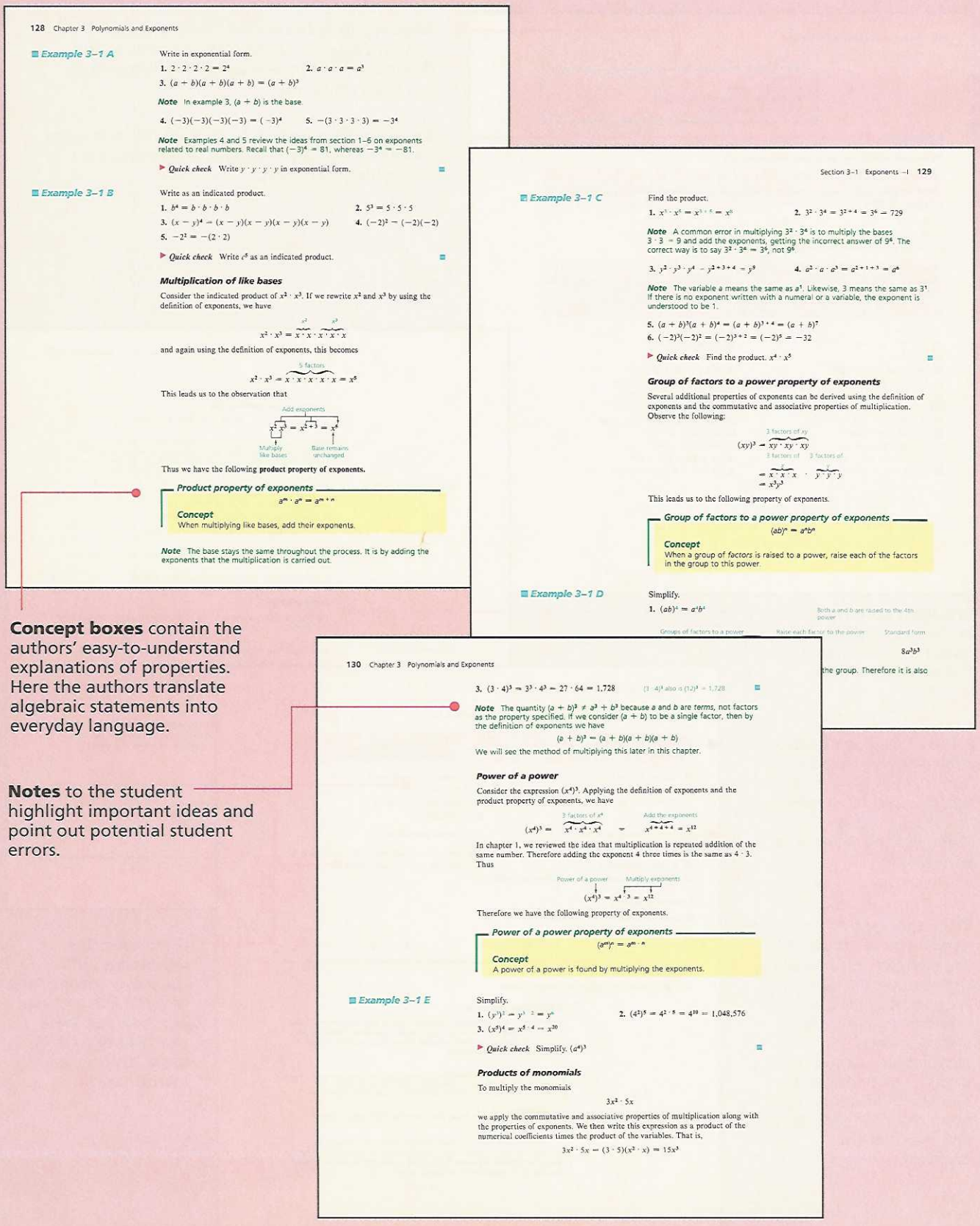
Example 2–3 D

Remove all grouping symbols and perform the indicated addition or subtraction.

1. $(3x^2 + 2x + 5) + (4x^2 + 3x + 6)$
   $= 3x^2 + 2x + 5 + 4x^2 + 3x + 6$ — Remove grouping symbols; Enclosed terms remain unchanged
   $= (3x^2 + 4x^2) + (2x + 3x) + (5 + 6)$ — Associative and commutative properties
   $= (3 + 4)x^2 + (2 + 3)x + 11$ — Distributive property
   $= 7x^2 + 5x + 11$ — Combine numerical coefficients

2. $(3x^2 - x + 4) - (2x^2 - 5x - 7)$
   $= 3x^2 - x + 4 - 2x^2 + 5x + 7$ — Remove grouping symbols; Change the sign of each term contained in the second set of parentheses
   $= (3x^2 - 2x^2) + (-x + 5x) + (4 + 7)$ — Associative and commutative properties
   $= (3 - 2)x^2 + (-1 + 5)x + 11$ — Distributive property
   $= 1x^2 + 4x + 11$ — Combine numerical coefficients
   $= x^2 + 4x + 11$ — x^2 is the same as $1x^2$

Note In the following examples, we will mentally add or subtract the like terms.



128 Chapter 3 Polynomials and Exponents

■ Example 3–1 A

Write in exponential form.

1. $2 \cdot 2 \cdot 2 \cdot 2 = 2^4$
2. $a \cdot a \cdot a = a^3$
3. $(a + b)(a + b)(a + b) = (a + b)^3$

Note In example 3, $(a + b)$ is the base.

4. $(-3)(-3)(-3)(-3) = (-3)^4$
5. $-(3 \cdot 3 \cdot 3 \cdot 3) = -3^4$

Note Examples 4 and 5 review the ideas from section 1–6 on exponents related to real numbers. Recall that $(-3)^4 = 81$, whereas $-3^4 = -81$.

▶ *Quick check* Write $y \cdot y \cdot y \cdot y$ in exponential form. ■

■ Example 3–1 B

Write as an indicated product.

1. $b^4 = b \cdot b \cdot b \cdot b$
2. $5^3 = 5 \cdot 5 \cdot 5$
3. $(x - y)^4 = (x - y)(x - y)(x - y)(x - y)$
4. $(-2)^2 = (-2)(-2)$
5. $-2^2 = -(2 \cdot 2)$

▶ *Quick check* Write c^5 as an indicated product. ■

Multiplication of like bases

Consider the indicated product of $x^2 \cdot x^3$. If we rewrite x^2 and x^3 by using the definition of exponents, we have

$$x^2 \cdot x^3 = \overbrace{x \cdot x}^{x^2} \cdot \overbrace{x \cdot x \cdot x}^{x^3}$$

and again using the definition of exponents, this becomes

$$x^2 \cdot x^3 = \overbrace{x \cdot x \cdot x \cdot x \cdot x}^{5 \text{ factors}} = x^5$$

This leads us to the observation that

Add exponents

$$x^2 \cdot x^3 = x^{2+3} = x^5$$

Multiply like bases — Base remains unchanged

Thus we have the following **product property of exponents.**

Product property of exponents

$$a^m \cdot a^n = a^{m+n}$$

Concept

When multiplying like bases, add their exponents.

Note The base stays the same throughout the process. It is by adding the exponents that the multiplication is carried out.

Section 3–1 Exponents—I 129

■ Example 3–1 C

Find the product.

1. $x^5 \cdot x^6 = x^{5+6} = x^{11}$
2. $3^2 \cdot 3^4 = 3^{2+4} = 3^6 = 729$

Note A common error in multiplying $3^2 \cdot 3^4$ is to multiply the bases $3 \cdot 3 = 9$ and add the exponents, getting the incorrect answer of 9^6. The correct way is to say $3^2 \cdot 3^4 = 3^6$, not 9^6.

3. $y^2 \cdot y^3 \cdot y^4 = y^{2+3+4} = y^9$
4. $a^2 \cdot a \cdot a^3 = a^{2+1+3} = a^6$

Note The variable a means the same as a^1. Likewise, 3 means the same as 3^1. If there is no exponent written with a numeral or a variable, the exponent is understood to be 1.

5. $(a + b)^3(a + b)^4 = (a + b)^{3+4} = (a + b)^7$
6. $(-2)^3(-2)^2 = (-2)^{3+2} = (-2)^5 = -32$

▶ *Quick check* Find the product. $x^4 \cdot x^5$ ■

Group of factors to a power property of exponents

Several additional properties of exponents can be derived using the definition of exponents and the commutative and associative properties of multiplication. Observe the following:

3 factors of xy

$$(xy)^3 = \overbrace{xy \cdot xy \cdot xy}^{\text{3 factors of } xy}$$

3 factors of x — 3 factors of y

$$= \overbrace{x \cdot x \cdot x}^{x^3} \cdot \overbrace{y \cdot y \cdot y}^{y^3}$$

$$= x^3y^3$$

This leads us to the following property of exponents.

Group of factors to a power property of exponents

$$(ab)^n = a^n b^n$$

Concept

When a group of *factors* is raised to a power, raise each of the factors in the group to this power.

■ Example 3–1 D

Simplify.

1. $(ab)^4 = a^4b^4$

Both a and b are raised to the 4th power

Groups of factors to a power — Raise each factor to the power — Standard form

$8a^3b^3$

the group. Therefore it is also

130 Chapter 3 Polynomials and Exponents

3. $(3 \cdot 4)^3 = 3^3 \cdot 4^3 = 27 \cdot 64 = 1{,}728$ $(3 \cdot 4)^3$ also is $(12)^3 = 1{,}728$ ■

Note The quantity $(a + b)^3 \neq a^3 + b^3$ because a and b are *terms*, not factors as the property specified. If we consider $(a + b)$ to be a single factor, then by the definition of exponents we have

$$(a + b)^3 = (a + b)(a + b)(a + b)$$

We will see the method of multiplying this later in this chapter.

Power of a power

Consider the expression $(x^4)^3$. Applying the definition of exponents and the product property of exponents, we have

3 factors of x^4 — Add the exponents

$$(x^4)^3 = \overbrace{x^4 \cdot x^4 \cdot x^4}^{3 \text{ factors of } x^4} = x^{4+4+4} = x^{12}$$

In chapter 1, we reviewed the idea that multiplication is repeated addition of the same number. Therefore adding the exponent 4 three times is the same as $4 \cdot 3$. Thus

Power of a power — Multiply exponents

$$(x^4)^3 = x^{4 \cdot 3} = x^{12}$$

Therefore we have the following property of exponents.

Power of a power property of exponents

$$(a^m)^n = a^{m \cdot n}$$

Concept

A power of a power is found by multiplying the exponents.

■ Example 3–1 E

Simplify.

1. $(y^3)^2 = y^{3 \cdot 2} = y^6$
2. $(4^2)^5 = 4^{2 \cdot 5} = 4^{10} = 1{,}048{,}576$
3. $(x^5)^4 = x^{5 \cdot 4} = x^{20}$

▶ *Quick check* Simplify. $(a^4)^3$ ■

Products of monomials

To multiply the monomials

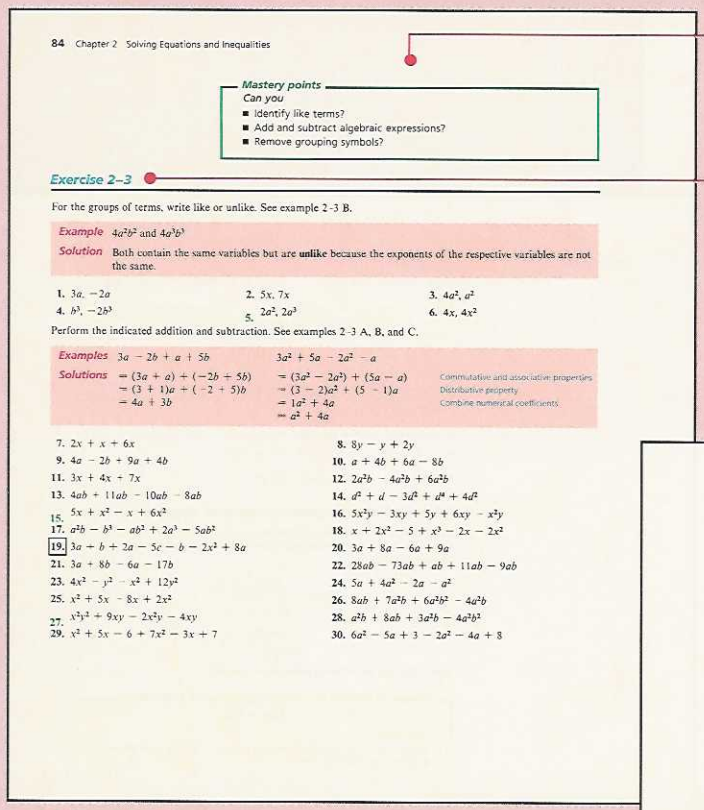
$$3x^2 \cdot 5x$$

we apply the commutative and associative properties of multiplication along with the properties of exponents. We then write this expression as a product of the numerical coefficients times the product of the variables. That is,

$$3x^2 \cdot 5x = (3 \cdot 5)(x^2 \cdot x) = 15x^3$$

Concept boxes contain the authors' easy-to-understand explanations of properties. Here the authors translate algebraic statements into everyday language.

Notes to the student highlight important ideas and point out potential student errors.



84 Chapter 2 Solving Equations and Inequalities

Mastery points
Can you
- Identify like terms?
- Add and subtract algebraic expressions?
- Remove grouping symbols?

Exercise 2–3

For the groups of terms, write like or unlike. See example 2-3 B.

Example $4a^2b^2$ and $4a^3b^3$

Solution Both contain the same variables but are **unlike** because the exponents of the respective variables are not the same.

1. $3a, -2a$
2. $5x, 7x$
3. $4a^2, a^2$
4. $b^3, -2b^3$
5. $2a^2, 2a^3$
6. $4x, 4x^2$

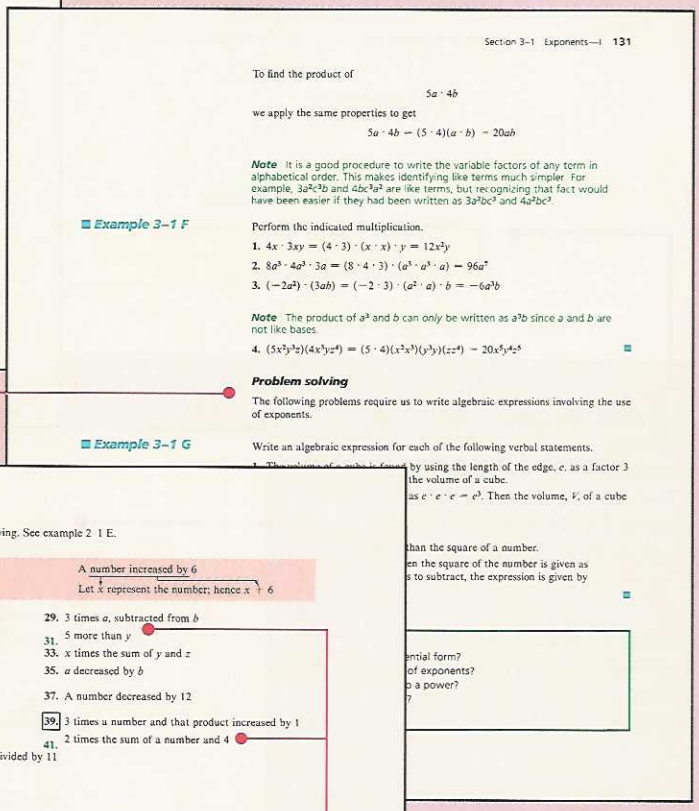
Perform the indicated addition and subtraction. See examples 2-3 A, B, and C.

Examples $3a - 2b + a + 5b$ $\quad 3a^2 + 5a - 2a^2 - a$

Solutions
$= (3a + a) + (-2b + 5b)$ Commutative and associative properties
$= (3 + 1)a + (-2 + 5)b$ Distributive property
$= 4a + 3b$ Combine numerical coefficients

$= (3a^2 - 2a^2) + (5a - a)$
$= (3 - 2)a^2 + (5 - 1)a$
$= 1a^2 + 4a$
$= a^2 + 4a$

7. $2x + x + 6x$
8. $8y - y + 2y$
9. $4a - 2b + 9a + 4b$
10. $a + 4b + 6a - 8b$
11. $3x + 4x + 7x$
12. $2a^2b - 4a^2b + 6a^2b$
13. $4ab + 11ab - 10ab - 8ab$
14. $d^2 + d - 3d^2 + d^4 + 4d^2$
15. $5x + x^2 - x + 6x^2$
16. $5x^2y - 3xy + 5y + 6xy - x^2y$
17. $a^2b - b^3 - ab^2 + 2a^3 - 5ab^2$
18. $x + 2x^2 - 5 + x^3 - 2x - 2x^2$
19. $3a + b + 2a - 5c - b - 2x^2 + 8a$
20. $3a + 8a - 6a + 9a$
21. $3a + 8b - 6a - 17b$
22. $28ab - 73ab + ab + 11ab - 9ab$
23. $4x^2 - y^2 - x^2 + 12y^2$
24. $5a + 4a^2 - 2a - a^2$
25. $x^2 + 5x - 8x + 2x^2$
26. $8ab + 7a^2b + 6a^2b^2 - 4a^2b$
27. $x^2y^2 + 9xy - 2x^2y - 4xy$
28. $a^2b + 8ab + 3a^2b - 4a^2b^2$
29. $x^2 + 5x - 6 + 7x^2 - 3x + 7$
30. $6a^2 - 5a + 3 - 2a^2 - 4a + 8$



Section 3–1 Exponents—I 131

To find the product of

$$5a \cdot 4b$$

we apply the same properties to get

$$5a \cdot 4b = (5 \cdot 4)(a \cdot b) = 20ab$$

Note It is a good procedure to write the variable factors of any term in alphabetical order. This makes identifying like terms much simpler. For example, $3a^2c^3b$ and $4bc^3a^2$ are like terms, but recognizing that fact would have been easier if they had been written as $3a^2bc^3$ and $4a^2bc^3$.

■ *Example 3–1 F*

Perform the indicated multiplication.

1. $4x \cdot 3xy = (4 \cdot 3) \cdot (x \cdot x) \cdot y = 12x^2y$
2. $8a^3 \cdot 4a^3 \cdot 3a = (8 \cdot 4 \cdot 3) \cdot (a^3 \cdot a^3 \cdot a) = 96a^7$
3. $(-2a^2) \cdot (3ab) = (-2 \cdot 3) \cdot (a^2 \cdot a) \cdot b = -6a^3b$

Note The product of a^3 and b can *only* be written as a^3b since a and b are not like bases.

4. $(5x^2y^3z)(4x^3yz^4) = (5 \cdot 4)(x^2x^3)(y^3y)(zz^4) = 20x^5y^4z^5$ ■

Problem solving

The following problems require us to write algebraic expressions involving the use of exponents.

■ *Example 3–1 G*

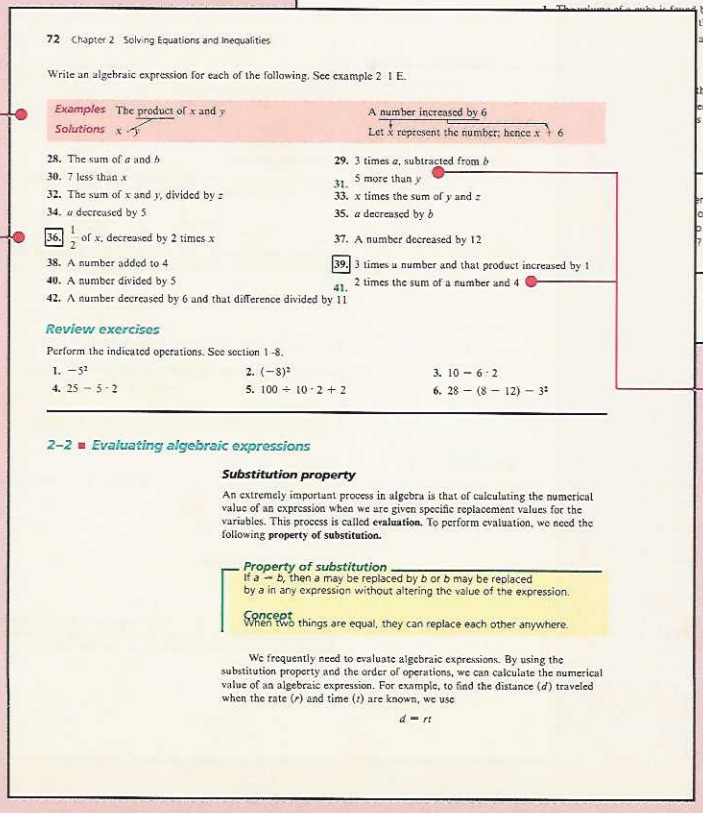
Write an algebraic expression for each of the following verbal statements.

1. The volume of a cube is found by using the length of the edge, e, as a factor 3 times. Thus the volume of a cube is $e \cdot e \cdot e = e^3$. Then the volume, V, of a cube

than the square of a number.

en the square of the number is given as
s to subtract, the expression is given by

ential form?
of exponents?
a power?
?



72 Chapter 2 Solving Equations and Inequalities

Write an algebraic expression for each of the following. See example 2-1 E.

Examples The product of x and y $\quad$ A number increased by 6

Solutions $x \cdot y$ $\quad$ Let x represent the number; hence $x + 6$

28. The sum of a and b
29. 3 times a, subtracted from b
30. 7 less than x
31. 5 more than y
32. The sum of x and y, divided by z
33. x times the sum of y and z
34. a decreased by 5
35. a decreased by b
36. $\frac{1}{2}$ of x, decreased by 2 times x
37. A number decreased by 12
38. A number added to 4
39. 3 times a number and that product increased by 1
40. A number divided by 5
41. 2 times the sum of a number and 4
42. A number decreased by 6 and that difference divided by 11

Review exercises

Perform the indicated operations. See section 1-8.

1. -5^2
2. $(-8)^2$
3. $10 - 6 \cdot 2$
4. $25 - 5 \cdot 2$
5. $100 \div 10 \cdot 2 + 2$
6. $28 - (8 - 12) - 3^2$

2–2 ■ *Evaluating algebraic expressions*

Substitution property

An extremely important process in algebra is that of calculating the numerical value of an expression when we are given specific replacement values for the variables. This process is called **evaluation.** To perform evaluation, we need the following **property of substitution.**

Property of substitution
If $a = b$, then a may be replaced by b or b may be replaced by a in any expression without altering the value of the expression.

Concept
When two things are equal, they can replace each other anywhere.

We frequently need to evaluate algebraic expressions. By using the substitution property and the order of operations, we can calculate the numerical value of an algebraic expression. For example, to find the distance (d) traveled when the rate (r) and time (t) are known, we use

$$d = rt$$

Mastery points are listed before each section's exercise set to alert students to the skills they must have mastered to successfully work the problems.

Exercise sets feature both algebraic and word problems that give students ample opportunity to practice their skills.

Problem solving motivates students by relating mathematics to the everyday world.

Fully worked-out **quick-reference examples** (quick check problems) are included for students to use as a line-by-line check of their work or as an example.

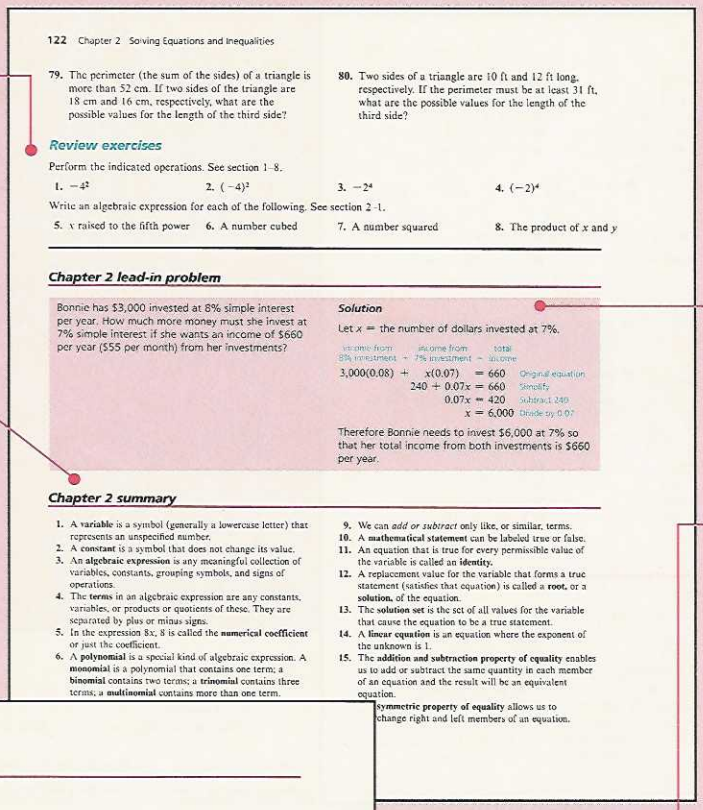
Trial exercise problems are located in the exercise sets and are denoted with a box around the problem number indicating that the solution is completely worked out in the answer appendix. The problem can be used as an example or line-by-line check of the problem.

Core exercise problems address the major ideas of the section. The problem numbers for these exercises appear in green type for easy identification.

Review exercises at the end of each section help students prepare for the following section and keep in touch with previous material.

A chapter **summary** synthesizes important concepts.

Chapter review exercises feature problems to help students determine if they need further work on a particular section. The problems are keyed to refer students back to the section from which they were drawn.



122 Chapter 2 Solving Equations and Inequalities

79. The perimeter (the sum of the sides) of a triangle is more than 52 cm. If two sides of the triangle are 18 cm and 16 cm, respectively, what are the possible values for the length of the third side?

80. Two sides of a triangle are 10 ft and 12 ft long, respectively. If the perimeter must be at least 31 ft, what are the possible values for the length of the third side?

Review exercises

Perform the indicated operations. See section 1–8.

1. -4^2 2. $(-4)^2$ 3. -2^4 4. $(-2)^4$

Write an algebraic expression for each of the following. See section 2–1.

5. x raised to the fifth power 6. A number cubed 7. A number squared 8. The product of x and y

Chapter 2 lead-in problem

Bonnie has $3,000 invested at 8% simple interest per year. How much more money must she invest at 7% simple interest if she wants an income of $660 per year ($55 per month) from her investments?

Solution

Let x = the number of dollars invested at 7%.

Income from 8% investment + Income from 7% investment = Total income

$3{,}000(0.08) + x(0.07) = 660$ Original equation

$240 + 0.07x = 660$ Simplify.

$0.07x = 420$ Subtract 240.

$x = 6{,}000$ Divide by 0.07.

Therefore Bonnie needs to invest $6,000 at 7% so that her total income from both investments is $660 per year.

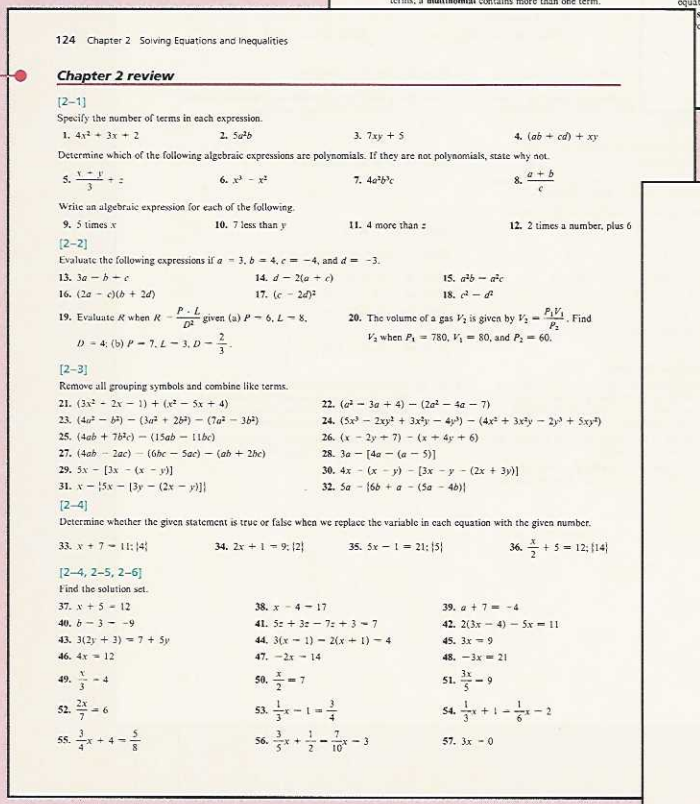
Chapter 2 summary

1. A **variable** is a symbol (generally a lowercase letter) that represents an unspecified number.
2. A **constant** is a symbol that does not change its value.
3. An **algebraic expression** is any meaningful collection of variables, constants, grouping symbols, and signs of operations.
4. The **terms** in an algebraic expression are any constants, variables, or products or quotients of these. They are separated by plus or minus signs.
5. In the expression $8x$, 8 is called the **numerical coefficient** or just the coefficient.
6. A **polynomial** is a special kind of algebraic expression. A **monomial** is a polynomial that contains one term; a **binomial** contains two terms; a **trinomial** contains three terms; a **multinomial** contains more than one term.
9. We can *add or subtract* only like, or similar, terms.
10. A **mathematical statement** can be labeled true or false.
11. An equation that is true for every permissible value of the variable is called an **identity.**
12. A replacement value for the variable that forms a true statement (satisfies that equation) is called a **root,** or a **solution,** of the equation.
13. The **solution set** is the set of all values for the variable that cause the equation to be a true statement.
14. A **linear equation** is an equation where the exponent of the unknown is 1.
15. The **addition and subtraction property of equality** enables us to add or subtract the same quantity in each member of an equation and the result will be an equivalent equation.

symmetric property of equality allows us to change right and left members of an equation.

The completely worked-out solution for the **chapter-opening word problem** appears at the end of the chapter prior to the chapter summary.

Error analysis provides a group of problems where a common error has been made. The student is asked to correct the mistake. A page reference is provided so that the student can refer to examples and notes relative to the given problem.



124 Chapter 2 Solving Equations and Inequalities

Chapter 2 review

[2–1]

Specify the number of terms in each expression.

1. $4x^2 + 3x + 2$ 2. $5a^2b$ 3. $7xy + 5$ 4. $(ab + cd) + xy$

Determine which of the following algebraic expressions are polynomials. If they are not polynomials, state why not.

5. $\frac{x + y}{3} + z$ 6. $x^3 - x^2$ 7. $4a^2b^3c$ 8. $\frac{a + b}{c}$

Write an algebraic expression for each of the following.

9. 5 times x 10. 7 less than y 11. 4 more than z 12. 2 times a number, plus 6

[2–2]

Evaluate the following expressions if $a = 3$, $b = 4$, $c = -4$, and $d = -3$.

13. $3a - b - c$ 14. $d - 2(a + c)$ 15. $a^2b - a^2c$

16. $(2a - c)(b + 2d)$ 17. $(c - 2d)^2$ 18. $c^2 - d^2$

19. Evaluate R when $R = \frac{P - L}{D^2}$ given (a) $P = 6$, $L = 8$, $D = 4$; (b) $P = 7$, $L = 3$, $D = \frac{2}{3}$.

20. The volume of a gas V_2 is given by $V_2 = \frac{P_1V_1}{P_2}$. Find V_2 when $P_1 = 780$, $V_1 = 80$, and $P_2 = 60$.

[2–3]

Remove all grouping symbols and combine like terms.

21. $(3x^2 - 2x - 1) + (x^2 - 5x + 4)$

22. $(a^2 - 3a + 4) - (2a^2 - 4a - 7)$

23. $(4a^2 - b^2) - (3a^2 + 2b^2) - (7a^2 - 3b^2)$

24. $(5x^3 - 2xy^2 + 3x^2y - 4y^3) - (4x^2 + 3x^2y - 2y^3 + 5xy^2)$

25. $(4ab + 7b^2c) - (15ab - 11bc)$

26. $(x - 2y + 7) - (x + 4y + 6)$

27. $(4ab - 2ac) - (6bc - 5ac) - (ab + 2bc)$

28. $3a - [4a - (a - 5)]$

29. $5x - [3x - (x - y)]$

30. $4x - (x - y) - [3x - y - (2x + 3y)]$

31. $x - \{5x - [3y - (2x - y)]\}$

32. $5a - \{6b + a - (5a - 4b)\}$

[2–4]

Determine whether the given statement is true or false when we replace the variable in each equation with the given number.

33. $x + 7 = 11$; $\{4\}$ 34. $2x + 1 = 9$; $\{2\}$ 35. $5x - 1 = 21$; $\{5\}$ 36. $\frac{x}{2} + 5 = 12$; $\{14\}$

[2–4, 2–5, 2–6]

Find the solution set.

37. $x + 5 = 12$ 38. $x - 4 = 17$ 39. $a + 7 = -4$

40. $b - 3 = -9$ 41. $5z + 3z - 7z + 3 = 7$ 42. $2(3x - 4) - 5x = 11$

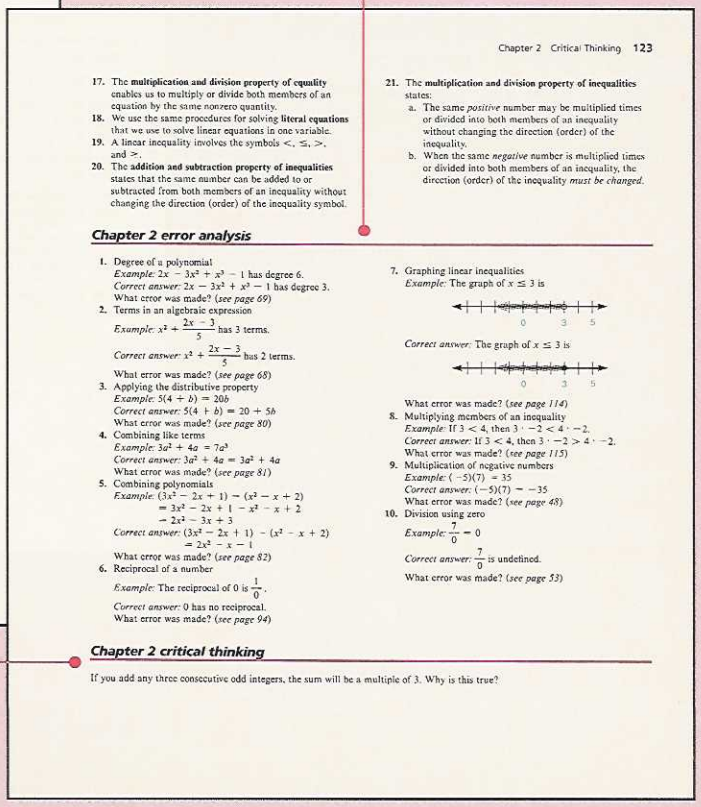
43. $3(2y + 3) = 7 + 5y$ 44. $3(x - 1) = 2(x + 1) - 4$ 45. $3x = 9$

46. $4x = 12$ 47. $-2x = 14$ 48. $-3x = 21$

49. $\frac{x}{3} = 4$ 50. $\frac{x}{2} = 7$ 51. $\frac{3x}{5} = 9$

52. $\frac{2x}{7} = 6$ 53. $\frac{1}{3}x - 1 = \frac{3}{4}$ 54. $\frac{1}{3}x + 1 = \frac{1}{6}x - 2$

55. $\frac{3}{4}x + 4 = \frac{5}{8}$ 56. $\frac{3}{5}x + \frac{1}{2} = \frac{7}{10}x - 3$ 57. $3x - 0$



Chapter 2 Critical Thinking 123

17. The **multiplication and division property of equality** enables us to multiply or divide both members of an equation by the same nonzero quantity.
18. We use the same procedures for solving **literal equations** that we use to solve linear equations in one variable.
19. A linear inequality involves the symbols $<$, $\leq$, $>$, and $\geq$.
20. The **addition and subtraction property of inequalities** states that the same number can be added to or subtracted from both members of an inequality without changing the direction (order) of the inequality symbol.
21. The **multiplication and division property of inequalities** states:
    a. The same *positive* number may be multiplied times or divided into both members of an inequality without changing the direction (order) of the inequality.
    b. When the same *negative* number is multiplied times or divided into both members of an inequality, the direction (order) of the inequality *must be changed.*

Chapter 2 error analysis

1. Degree of a polynomial
   Example: $2x - 3x^2 + x^3 - 1$ has degree 6.
   Correct answer: $2x - 3x^2 + x^3 - 1$ has degree 3.
   What error was made? (*see page 69*)
2. Terms in an algebraic expression
   Example: $x^2 + \frac{2x - 3}{5}$ has 3 terms.
   Correct answer: $x^2 + \frac{2x - 3}{5}$ has 2 terms.
   What error was made? (*see page 68*)
3. Applying the distributive property
   Example: $5(4 + b) = 20b$
   Correct answer: $5(4 + b) = 20 + 5b$
   What error was made? (*see page 80*)
4. Combining like terms
   Example: $3a^2 + 4a = 7a^3$
   Correct answer: $3a^2 + 4a = 3a^2 + 4a$
   What error was made? (*see page 81*)
5. Combining polynomials
   Example: $(3x^2 - 2x + 1) - (x^2 - x + 2)$
   $= 3x^2 - 2x + 1 - x^2 - x + 2$
   $= 2x^2 - 3x + 3$
   Correct answer: $(3x^2 - 2x + 1) - (x^2 - x + 2)$
   $= 2x^2 - x - 1$
   What error was made? (*see page 82*)
6. Reciprocal of a number
   Example: The reciprocal of 0 is $\frac{1}{0}$.
   Correct answer: 0 has no reciprocal.
   What error was made? (*see page 94*)
7. Graphing linear inequalities
   Example: The graph of $x \leq 3$ is

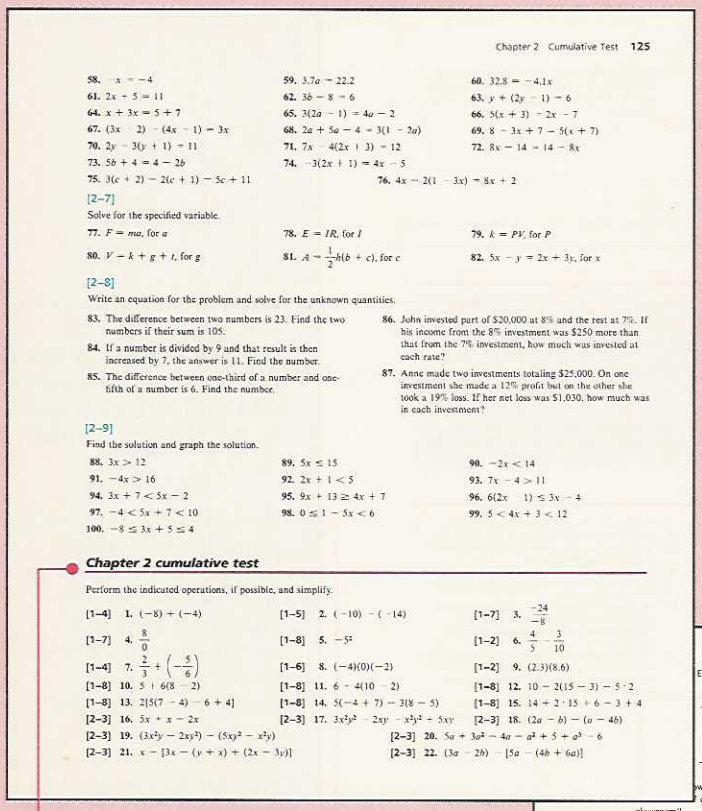
   Correct answer: The graph of $x \leq 3$ is

   What error was made? (*see page 114*)
8. Multiplying members of an inequality
   Example: If $3 < 4$, then $3 \cdot -2 < 4 \cdot -2$.
   Correct answer: If $3 < 4$, then $3 \cdot -2 > 4 \cdot -2$.
   What error was made? (*see page 115*)
9. Multiplication of negative numbers
   Example: $(-5)(7) = 35$
   Correct answer: $(-5)(7) = -35$
   What error was made? (*see page 48*)
10. Division using zero
    Example: $\frac{7}{0} = 0$
    Correct answer: $\frac{7}{0}$ is undefined.
    What error was made? (*see page 53*)

Chapter 2 critical thinking

If you add any three consecutive odd integers, the sum will be a multiple of 3. Why is this true?

Critical thinking provides special problems that the student must analyze and use their mathematical skills to solve. A series of hints are given in the Instructors Manual.



Chapter 2 Cumulative Test 125

58. $-x = -4$
59. $3.7a - 22.2$
60. $32.8 = -4.1x$
61. $2x + 5 = 11$
62. $3b - 8 = 6$
63. $y + (2y - 1) = 6$
64. $x + 3x = 5 + 7$
65. $3(2a - 1) = 4a - 2$
66. $5(x + 3) - 2x - 7$
67. $(3x - 2) - (4x - 1) = 3x$
68. $2a + 5a - 4 = 3(1 - 2a)$
69. $8 - 3x + 7 - 5(x + 7)$
70. $2y - 3(y + 1) = 11$
71. $7x - 4(2x + 3) = 12$
72. $8x - 14 = 14 - 8x$
73. $5b + 4 = 4 - 2b$
74. $-3(2x + 1) = 4x - 5$
75. $3(c + 2) - 2(c + 1) = 5c + 11$
76. $4x - 2(1 - 3x) = 8x + 2$

[2–7]
Solve for the specified variable.

77. $F = ma$, for a
78. $E = IR$, for I
79. $k = PV$, for P
80. $V = k + g + t$, for g
81. $A = \frac{1}{2}b(b + c)$, for c
82. $5x - y = 2x + 3y$, for x

[2–8]
Write an equation for the problem and solve for the unknown quantities.

83. The difference between two numbers is 23. Find the two numbers if their sum is 105.
84. If a number is divided by 9 and that result is then increased by 7, the answer is 11. Find the number.
85. The difference between one-third of a number and one-fifth of a number is 6. Find the number.
86. John invested part of $20,000 at 8% and the rest at 7%. If his income from the 8% investment was $250 more than that from the 7% investment, how much was invested at each rate?
87. Anne made two investments totaling $25,000. On one investment she made a 12% profit but on the other she took a 19% loss. If her net loss was $1,030, how much was in each investment?

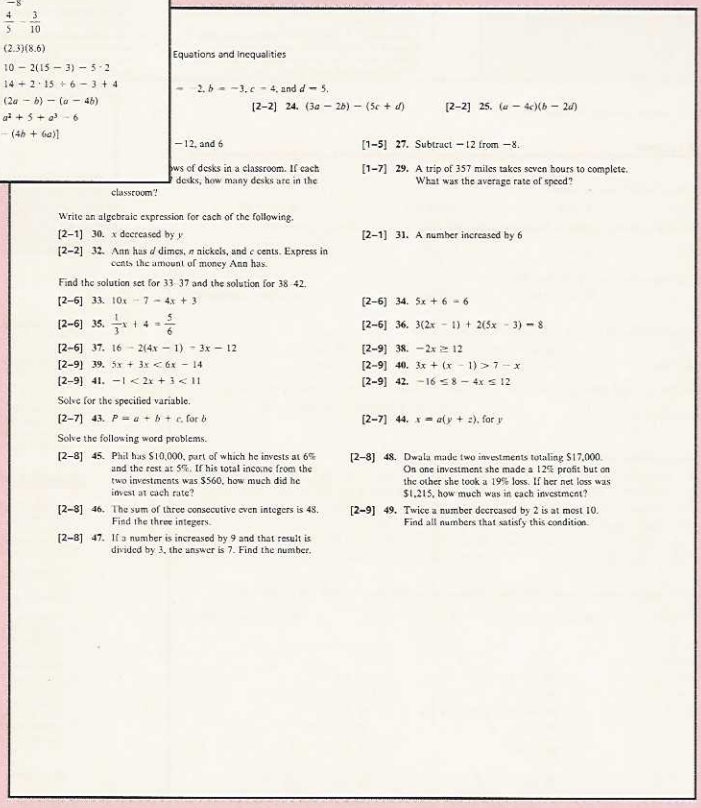
[2–9]
Find the solution and graph the solution.

88. $3x > 12$
89. $5x \le 15$
90. $-2x < 14$
91. $-4x > 16$
92. $2x + 1 < 5$
93. $7x - 4 > 11$
94. $3x + 7 < 5x - 2$
95. $9x + 13 \ge 4x + 7$
96. $6(2x - 1) \le 3x - 4$
97. $-4 < 5x + 7 < 10$
98. $0 \le 1 - 5x < 6$
99. $5 < 4x + 3 < 12$
100. $-8 \le 3x + 5 \le 4$

Chapter 2 cumulative test

Perform the indicated operations, if possible, and simplify.

[1–4] 1. $(-8) + (-4)$
[1–5] 2. $(-10) - (-14)$
[1–7] 3. $\frac{-24}{-8}$
[1–7] 4. $\frac{8}{0}$
[1–8] 5. -5^2
[1–2] 6. $\frac{4}{5} - \frac{3}{10}$
[1–4] 7. $\frac{2}{3} + \left(-\frac{5}{6}\right)$
[1–6] 8. $(-4)(0)(-2)$
[1–2] 9. $(2.3)(8.6)$
[1–8] 10. $5 + 6(8 - 2)$
[1–8] 11. $6 \div 4(10 - 2)$
[1–8] 12. $10 - 2(15 - 3) - 5 \cdot 2$
[1–8] 13. $2[5(7 - 4) - 6 + 4]$
[1–8] 14. $5(-4 + 7) - 3(8 - 5)$
[1–8] 15. $14 + 2 \cdot 15 \div 6 - 3 + 4$
[2–3] 16. $5x + x - 2x$
[2–3] 17. $3x^2y^2 - 2xy - x^2y^2 + 5xy$
[2–3] 18. $(2a - b) - (a - 4b)$
[2–3] 19. $(3x^2y - 2xy^2) - (5xy^2 - x^2y)$
[2–3] 20. $5a + 3a^2 - 4a - a^2 + 5 + a^3 - 6$
[2–3] 21. $x - [3x - (y + x) + (2x - 3y)]$
[2–3] 22. $(3a - 2b) - [5a - (4b + 6a)]$



Equations and inequalities

$= -2$, $b = -3$, $c = 4$, and $d = 5$.

[2–2] 24. $(3a - 2b) - (5c + d)$
[2–2] 25. $(a - 4c)(b - 2d)$

-12, and 6

[1–5] 27. Subtract -12 from -8.

ows of desks in a classroom. If each desks, how many desks are in the classroom?

[1–7] 29. A trip of 357 miles takes seven hours to complete. What was the average rate of speed?

Write an algebraic expression for each of the following.

[2–1] 30. x decreased by y
[2–1] 31. A number increased by 6
[2–2] 32. Ann has d dimes, n nickels, and c cents. Express in cents the amount of money Ann has.

Find the solution set for 33–37 and the solution for 38–42.

[2–6] 33. $10x - 7 = 4x + 3$
[2–6] 34. $5x + 6 = 6$
[2–6] 35. $\frac{1}{3}x + 4 = \frac{5}{6}$
[2–6] 36. $3(2x - 1) + 2(5x - 3) = 8$
[2–6] 37. $16 - 2(4x - 1) = 3x - 12$
[2–9] 38. $-2x \ge 12$
[2–9] 39. $5x + 3x < 6x - 14$
[2–9] 40. $3x + (x - 1) > 7 - x$
[2–9] 41. $-1 < 2x + 3 < 11$
[2–9] 42. $-16 \le 8 - 4x \le 12$

Solve for the specified variable.

[2–7] 43. $P = a + b + c$, for b
[2–7] 44. $x = a(y + z)$, for y

Solve the following word problems.

[2–8] 45. Phil has $10,000, part of which he invests at 6% and the rest at 5%. If his total income from the two investments was $560, how much did he invest at each rate?
[2–8] 46. The sum of three consecutive even integers is 48. Find the three integers.
[2–8] 47. If a number is increased by 9 and that result is divided by 3, the answer is 7. Find the number.
[2–8] 48. Dwala made two investments totaling $17,000. On one investment she made a 12% profit but on the other she took a 19% loss. If her net loss was $1,215, how much was in each investment?
[2–9] 49. Twice a number decreased by 2 is at most 10. Find all numbers that satisfy this condition.

Cumulative tests emphasize the "building-block" nature of mathematics and help students retain knowledge and skills from previous chapters.

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Preface

Elementary Algebra with Applications is a beginning level text designed specifically for students who have not had a previous course in algebra. The book can be used in lecture-discussion classes or self-paced classes.

Problem-solving orientation The emphasis on problem solving begins in chapter 1 with word problems that have simple arithmetic solutions. The student also learns to change word phrases into algebraic expressions. In chapter 3 and throughout the rest of the text, the student is shown how to form and solve equations from word problems. **Diagrams** are used to show how the words are translated into mathematical symbols. **Tables** are provided to illustrate how several different word phrases become the same mathematical expression.

Critical thinking To encourage students to approach problems creatively in mathematics and the real world, we have included a critical thinking exercise in each chapter.

Error analysis Students can effectively increase their level of understanding of mathematical concepts by evaluating problems illustrating some of the most common mathematical errors. This strengthens the student's understanding of the concept and provides extra practice restating the concept in their own words.

Readability We have attempted to make the text as readable and accessible to students as possible by presenting the material in a manner similar to that which the instructor might use in the classroom.

Applications We have tried to provide a cross section of applications, mainly in the exercises. These are provided to help answer the perennial question "Why am I studying this stuff?" and to make the learning process itself more interesting. In particular, we have tried to show that algebra has become more important than ever in this age of the digital computer. Most ideas are supported by real-life applications relative to that concept.

Functional use of color In this third edition, color has been used to guide students through the text and clearly show the hierarchy of the text's elements. The effective use of color for each particular text element groups similar kinds of elements and helps students understand the relative importance of the elements.

- **Green** is reserved for the core ideas and core exercise problems presented in each chapter; it is used to highlight procedures, properties, definitions, notes, mastery points, and core exercise problems.
- **Blue** is used to emphasize explanations within the examples and exposition.
- **Red** is used to highlight extra practice opportunities for students within the development of each topic.

Highlights of the learning aids

Examples Examples present all aspects of the material being studied with a step-by-step development showing how the problem is worked. Examples have short phrase statements in **blue** type next to most steps stating exactly what has been done. The student is able to develop a clear understanding of how a problem is worked without having to guess what went on in a particular step.

Quick check exercises These exercises after a set of examples are designed to involve the student with the material while studying it. Quick check exercises directly parallel the development and examples in the text. As each new idea or procedure is illustrated with a set of examples, the student is asked to work a similar problem. A **red** triangle identifies each quick check exercise. Quick check exercises are worked step-by-step as quick-reference examples within the exercise set.

Procedure boxes Procedure boxes clearly state a step-by-step summary of the process by which types of problems are to be worked. **Green** has been consistently used for all procedure boxes to emphasize their importance to students.

Concept boxes Concept boxes include properties, theorems, or definitions along with an explanation in easy-to-understand language. **Green** is used to outline each concept box, emphasizing its importance.

Notes Notes to the student highlight important ideas and point out potential errors that students might make. The notes are printed in **green** type to attract the student's attention and emphasize their importance.

Mastery points Mastery points are listed before each exercise set. In essence, they are objectives for that section. They are specifically placed in this location to alert students to the particular skills they must know to successfully work the problems. When students have completed the section, the objectives have more meaning. The **green** outlined box is used to draw the students' attention to the mastery points before they begin the exercise set and to mark the mastery points as covering part of the main ideas of the section.

Exercise sets Exercise sets provide abundant opportunities for students to check their understanding of the concepts being presented. The problems in the exercise sets are carefully paired and graded by level of difficulty to guide the students easily from straightforward computations to more challenging, multi-step problems.

Green type problem numbers identify the core exercise problems in each exercise set.

The directions for each group of problems refer the student to a specific group of parallel examples. After each set of directions is a **quick-reference example**. This example is a specifically chosen quick check exercise from the section and is worked and explained step-by-step. The **red** shading over each quick reference example tells students it is related to the quick check exercises. Students can use this as a line-by-line check of their solution if they worked the problem while studying the material, or as an example they can refer to while working the exercise set.

Review exercises At the end of each section is a group of review problems. These exercises help reinforce the skills necessary for success in the following section. Answers are provided for all the review exercises.

Trial exercise problems Trial exercise problems appear throughout each exercise set and are denoted by a box around the problem number. This indicates that the solution is shown in its entirety in the answer appendix.

Chapter summaries End-of-chapter summaries synthesize the important ideas of each chapter.

Error analysis At the end of each chapter is a group of problems in which a typical error has been made. The student is asked to find and correct the mistake. If the student cannot find the error, a page reference is given which directs the student back to a specific note or group of examples that focus on this problem. Error analysis helps students increase their ability to find errors when checking their solutions, and encourages them to practice restating the important ideas of the chapter in their own words.

Critical thinking Following error analysis is a special problem that requires the student to analyze a problem and use their mathematical skills to answer it. The *Instructor's Resource Manual* contains a series of hints that can be used to guide the student through the analysis of the problem. The *Instructor's Resource Manual* also discusses various ways that critical thinking can be integrated into your course.

Chapter review A chapter review is placed at the end of each chapter. This problem set follows the same organization as the chapter. Each problem is keyed to the section from which it was drawn. Answers to all review problems are provided in the appendix.

Cumulative tests Cumulative tests give students the opportunity to work problems that are drawn from the chapter and from preceding chapters. If students need to review, they can use the section references to review the concept.

Answers Answers are given for all odd-numbered section exercise problems. The answers to all problems in the chapter reviews and cumulative tests are provided in the appendix.

New to this edition

Content

1. The arithmetic review has been moved from the appendix and is now in the opening chapter.
2. Solving equations, verbal problems, formulas, and linear inequalities have been moved from chapter 3 in the second edition to chapter 2 in the third edition to start the student on these concepts earlier.
3. Introduction to exponents has been moved to chapter 3 from chapter 2 in the first edition. In section 3–4,

special attention is now given to helping students effectively distinguish between the various operations with exponents and to apply the correct techniques to exponents.

4. Chapter 4 now includes a section on general strategies for factoring to improve the students' abilities to determine the correct factoring strategy to apply when encountering a variety of equation types to factor.
5. Addition and subtraction of rational expressions with like denominators is now covered in a separate section (6–2) before addition and subtraction of rational expressions with unlike denominators (6–3).
6. In chapter 7, the topic of functions of linear equations is now developed after equations in two variables.
7. Solutions of systems of linear equations is now developed with graphical solutions in section 8–1.
8. Systems of linear equations in three variables is not covered in the third edition.

Features

1. Quick-reference problems are worked out in the exercise sets to serve as further examples for the student.
2. Review exercises at the end of each section have been added to help prepare the student for the work of the following section.
3. Greater use of arrows to point up important steps taken in the development of an example.
4. *All* step-by-step procedures outlined for the major concepts are placed in boxes for emphasis.
5. Each chapter is introduced with an application problem (an accompanying related photo) that can be solved using the procedures studied in the ensuing chapter. The application problem is worked out in detail at the end of the chapter, just prior to the chapter summary for that chapter.
6. Error Analysis in each chapter helps students find errors and apply concepts in their own terms.
7. Critical Thinking activities in each chapter help students learn to address multi-step complex problems.
8. Color is used to clearly show which elements are related and to highlight the important concepts for the students.

For the instructor

The ***Instructor's Resource Manual*** has been expanded to include all critical thinking exercises from the text (with hints and solutions), a guide to the supplements that accompany *Elementary Algebra with Applications,* Third Edition, and reproducible quizzes, multiple chapter tests, and extension problems. Also included are a complete listing of all mastery points and suggested course schedules based on the mastery points. The final section of the *Instructor's Resource Manual* contains answers to the reproducible materials.

The ***Instructor's Solutions Manual*** contains completely worked-out solutions to all of the exercises in the textbook.

The ***Educator's Notebook*** is designed to assist you in formatting and presenting the concepts of *Elementary Algebra with Applications,* Third Edition to your students. Reproducible transparency masters are provided for each section of the textbook.

The ***Test Item File/Quiz Item File*** is a printed version of the computerized *TestPak* and *QuizPak* that allows you to choose test items based on chapter, section, or objective. The objectives are taken directly from the mastery points in *Elementary Algebra with Applications*, Third Edition. The items in the *Test Item File* and *Quiz Item File* are different from those in the prepared tests in the *Instructor's Manual.* Hence, you will have even more items to choose from for your tests.

WCB TestPak 3.0, our computerized testing service, provides you with a call-in/mail-in testing program and the complete *Test Item File* on diskette for use with IBM® PC, Apple®, or Macintosh® computers. *WCB TestPak* requires no programming experience. Tests can be generated randomly, by selecting specific test items or mastery points/objectives. In addition, new test items can be added and existing test items can be edited.

WCB GradePak, also a part of *TestPak 3.0*, is a computerized grade management system for instructors. This program allows you to track students' performance on examinations and assignments. It will compute each student's percentage and corresponding letter grade, as well as the class average. Printouts can be made utilizing both text and graphics.

WCB TestPak 3.0 disks and the WCB call-in service are available free to instructors adopting *Elementary Algebra with Applications*, Third Edition.

WCB QuizPak can be used to give your students on-line practice with the topics of elementary algebra. You can choose multiple-choice and true-false items from the Quiz Item File, edit items, or add your own items. Students' on-line test results are graded and scores then recorded in a GradePak file.

For the student

The ***Student's Solutions Manual*** contains overviews of every chapter of the text, chapter self-tests with solutions, and solutions to all proficiency checks, every other odd-numbered section exercise, and odd-numbered chapter review exercise problems. It is available for student purchase.

On the ***Videotapes***, the instructor introduces a concept, provides detailed explanations of example problems that illustrate the concept, including applications, and concludes with a summary. All of the topics presented in each section of *Elementary Algebra with Applications*, Third Edition are carefully reinforced by the comprehensive Wesner and Nustad Video series. The tapes are available free to qualified adopters.

The **Audiotapes** have also been developed specifically to accompany *Elementary Algebra with Applications,* Third Edition. They begin with a complete synopsis of the section, followed by clear discussions of examples with warning and hints where appropriate. Exercises are solved for each section of the text. Students are directed to turn off the tape and solve a specific problem and turn the tape on again for a complete explanation of the correct solution.

The concepts and skills developed in *Elementary Algebra with Applications*, Third Edition are reinforced though the interactive **Elementary Algebra Tutorial Practice Software.** Students practice solving section-referenced problems generated by the computer and review the major topics of elementary algebra. Step-by-step solutions with explanations guide students to mastery of the major concepts and skills of elementary algebra.

WCB QuizPak, a part of *TestPak 3.0*, provides students with true/false and matching questions from the *Quiz Item File* for each chapter in the text. Using this portion of the program will help your students prepare for examinations. Items in *QuizPak* are similar in level and coverage of concepts as the *TestPak* items. Also included with the *WCB QuizPak* is an on-line testing option that allows professors to prepare tests for students to take using the computer. The computer will automatically grade the test and update the gradebook file.

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Martha Jordan
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Judy Kasabian
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Joanne F. Korsmo
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Study tips

When you work to your full capacity, you can hope to attain the knowledge and skills that will enable you to create your future and control your destiny. If you do not, you will have your future thrust upon you by others.

A Nation at Risk *

There are certain study skills that you as an algebra student need to have, or develop, to assure your success in this course. In addition to the following items listed, acquaint yourself with the text by reading the preface material that precedes these study tips. Then—

1. For every hour spent in class, plan to spend at least two hours studying outside class.
2. Before going to class, read the material to be covered. This will help you more easily understand the instructor's presentation.
3. Take time to become familiar with the learning aids in your textbook. This will allow you to get the maximum benefit from them. In *Elementary Algebra with Applications,* Third Edition color has been used to tie related features together.
   - **Green** is used for the core concepts, ideas, and exercises. Be sure you understand everything highlighted with green.
   - **Blue** indicates additional explanation and greater detail.
   - **Red** is used to identify quick checks and quick-reference examples, which give you greater opportunity to check your understanding of each problem type.
4. Review the material related to each exercise set *before* attempting to work the problems. Be sure you understand the underlying concepts in the worked-out examples and the reason for each step.
5. Carefully read the instructions to the exercise set. Look at the examples and determine what is being asked. Remember, these same instructions will most likely appear on tests.
6. When working the exercise set, take your time, think about what you are doing in each step, and ask yourself why you are performing that step. As you become more confident, increase your speed to better prepare yourself for test situations.
7. When working the exercise sets, compare examples to see in what ways they are alike and in what ways they are different. Problems often *look* similar but are not.

If you do not know how to begin a problem, or you get partway through and are unable to proceed, (a) look back through your notes or (b) look for an exercise you can do that has the answer given and try to analyze the similarities. If doing these things does not work, put the problem aside. Often getting away from it for a time will "open the door" when you try it again. Finally, if you need to, consult your instructor and show him/her the work you have done.

The fact that you will be "using tomorrow what you are doing today" makes it imperative that you learn each concept as you go along. Most concepts, especially the ones that give you the most difficulty, need constant review.

The practice of checking your work will aid you in two ways:

1. It will develop confidence, knowing you have done the problem correctly.
2. It will help you discover your errors on an exam that might otherwise have gone undetected had you not checked your work.

When checking your work, use a different method from the one you used to solve the problem. If the same procedure is used, a tendency to make the same mistake exists. Develop methods for checking your work as you do the practice exercises. This checking then becomes automatic when taking a test.

The following hints will aid you in preparing for an exam:

1. Begin studying and reviewing a number of days prior to the exam. This will enable you to contact your instructor for help if you need it. "All-night" sessions the night before the exam seldom (if ever) yield good results.

*The National Commission on Excellence in Education. *A Nation at Risk.* Washington, D.C.: U.S. Government Printing Office, 1983.

2. Take periodic breaks—10 to 15 minutes for each hour of study. Study for no longer than four hours at a time.
3. Work to develop understanding as well as skills. Memorization is seldom useful in an algebra course, so concentrate on understanding the methods and concepts. However do not ignore skill development, since doing so can often lead to what students call "stupid mistakes."

Prior to taking an exam, use the exercise sets, chapter reviews, and/or *Student's Solutions Manual* to make out a practice test, determine where your errors lie, and retake the test to be sure that you have corrected the mistakes. Allot the same amount of time you will be allowed on test day.

When taking the algebra exam you should:

1. Look over the exam to locate the easiest problems.
2. Work these problems first.
3. Work the more difficult and time-consuming problems next. Remember, when stuck on a problem, go on to other problems and return to those giving you difficulty *only after* completing all that you can.
4. Use what time remains to check your answers or to rework those problems that you found most difficult.

Don't panic should you "draw a blank." Avoid thoughts of failure. Should you feel this happening, relax and try to clear your mind. Search out the problems you feel most confident about and begin again. Should you be unable to complete the exam, be sure to check the problems that you have completed. Always be aware of the time remaining. Do not hurry and do not be intimidated by other students competing the exam early.

One final bit of advice. Show your work neatly. Develop this habit when working on your practice problems. There is a close correlation between neatly laid-out work and the correct answer. Your instructor will appreciate this and be more inclined to give you more credit if the answer is wrong.